"A RUNNING IN TRAILS"

by

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Seeing so many of you before me who are similarly garbed, similarly equipped, similarly habited, I am reminded that there exist in many parts of the world various species of a subfamily of ants, the Dolichoderinae, whose individuals characteristically run in trails, in well established paths, maintaining the same highways throughout many generations. I personally know of several colonies of these trail-running ants that have maintained for fifteen years practically the same path, extending thirty yards or so from the hollow trunk of the home tree across ledges, under leaves and grass, and over logs to some other tree or to bushes where their aphids are pastured or other food supplies are found. These species of ants are essentially blind; they run by scent; the nest odor is maintained along the trails through the constant passing to and fro of the hundreds or thousands of members of the colony. Indeed, the job of many of these organic automata appears to be the spreading of the smell, the maintaining of the path, the following literally in the footsteps of the former generations. In their semi-blindness they rarely try the new. The inherited social habits suffice year after year, generation after generation.

When a new brood of ants is hatched and passes through its preparatory larval stages, it is impregnated automatically with the colony odor. The education proceeds through the callow stage; the young callows are exposed to radiation, their body surfaces darken and become hard; the young ants become adults, and then, dressed up with caps and gowns or the analogous vestments of the formicine world, they start the endless patrolling to and fro, saluting each other with twiddling antennae, maintaining the status quo, keeping alive the social smell that has been established by their fore-

runners. Some bring back honeydew or other food to nourish the next generation of larvae and callows so that they too may go through their training to adulthood, and, with diplomas under their arms, start out along the well-established path, saluting each fellow in passing, checking up that he too is conforming to the colony's customs and is in good odor.

Occasionally, by accident or by some psychic aberration, a trail runner gets off the beaten path and ventures out alone. Usually he becomes wholly lost, or after random wanderings stumbles back on to the good old trail. Occasionally one of these vagrants is followed by a fellow or two, but the new divergent trail with its slight and uncertain odors has relatively little appeal; devoid of vision these timid adventurers hurriedly smell their way back to the well scented customs and go on running to and fro, twiddling antennae with those who do likewise, happy apparently to keep clear of those realms that have not the proper social fragrance.

If a natural calamity disturbs the aromatic trail of the Dolichoderinae, consternation and helplessness ensue. If a strange insect appears, blind fighting results—then back to patrolling out and in; a sudden obstruction on the path, brief excitement follows, and the trail is re-established with as little diversion as possible from the former path, and on they go as before; a sudden depression, and there result wholly thoughtless and random movements, the goal apparently being to get out of the depression and on to the travelled way, back to the old order, back to the beaten path, no matter how circuitous or absurd it may be, back to the saluting, the twiddling, and the maintenance of the old social aroma.

Out at the limits of measured space are great spiral nebulae or galaxies, so distant that they can be seen only with the most powerful telescopes—so remote that light requires a hundred million years or more to come across the intervening emptiness. Some of these objects have revealed the phenomenon called the red shift. The light waves are found to be shifted, when studied with the spectroscope, toward the red end of the spectrum. The

blue light has become greenish, the green light has become somewhat yellow, the yellow light somewhat orange, the orange light red. The cosmogonist generally attributes this red shift to the effective lengthening of the light waves through the speedy recession of the nebulae emitting the light. The remotest measured spirals recede (on this interpretation) with the astounding speed of twenty thousand miles a second; those of half the distance at ten thousand miles a second; at a quarter of the distance, at five thousand miles a second. The whole system of galaxies, millions in number, each with its billions of stars, appears to be rapidly expanding. The motions are such that observers here or in the Andromeda spiral, or anywhere in the universe, would see all other systems receding from them with a speed increasing with the distance.

Now there are those among the cosmogonists who question this interpretation of the observed red shift; it may be, they maintain, that the reddening results from leaking photons—that is, from a loss of energy in the radiation during the thousands or millions of years intervening between emission from the surface of stars in the distant galaxies and the reception of these radiations by the observer with his spectroscope. If the energy degrades, if the photon leaks, the corresponding wave length increases, the color reddens. This assumption of a degradation appears to me as reasonable as the alternative view that the photon remains constant notwithstanding its long experience with space and time; but the assumption robs us of the fascinating conception of an expanding universe with its short time scale of but a few thousand million years.

But whether this Metagalactic system, this universe of galaxies, is expanding or is holding fast in finite space-time to constant dimensions, it is clear that the universe of knowledge is expanding at a terrific rate—expanding in all directions, while the Dolichoderinae and similar organisms, unchanged in size and outlook, continue to twiddle their antennae along familiar trails.

Consider the fulness of the material universe, and the

relative emptiness of human vision. We think of the universe about us as of immeasurable greatness, into which our meagre minds can scarcely begin to pierce. But is it literally so full, and human penetration so slight? Let us try as an experiment applying vision to the problem of space and matter. There are not many so presumptuous as to try to contemplate the material universe as a whole. Very few, even among astronomers and philosophers, pay any attention to it—natural reaction, perhaps, because certainly the universe pays no attention to us. I have found, however, that it is possible and very diverting to ponder about a relatively large portion of the Cosmos, and have recently taken a part in a census of the galaxies—a study of the inner parts of the metagalaxy.

We begin our survey with the local stellar system (a typical galaxy) which contains our Sun along with some thousand million other stars. The census reveals that, although only three or four other galaxies are so near that we can see them with the unaided eye, with the telescope such systems are found in abundance, all beyond the bounds of the Milky Way. The survey has now gone ten million light years into space in all directions, and shows to this distance something over one thousand galactic systems; that is, one galaxy for every two million trillion cubic light years. We can estimate the dimensions of a galaxy; we can compute the mass of the average star; we can therefore calculate the amount of matter per cubic inch or cubic mile throughout the space we have surveyed. Notwithstanding the appalling abundance of stars (at least a billion billion) and their enormous dimensions when referred to earthly standards, we find a surprising emptiness throughout the universe. There is, on the average, only one typical atom for each million cubic inches. And an atom is not a very filling entity. It takes, for instance, about five hundred million trillion of them, appropriately assembled, to make one house-fly. You can, perhaps, better appreciate the degree of emptiness throughout the known universe when I point out that if you dismember the house-fly and spread him throughout

a volume (otherwise empty) as large as the volume of the earth, the resulting density of material would be ten times as great as the average density prevailing throughout all explored space. There would be ten atoms of fly-stuff for each million cubic inches.

In contrast to the scarcity of material the world over, there is everywhere throughout interstellar and intergalactic space light of all the known stars and planets. Radiation from all parts of the discernible universe is continually passing through every point—light that carries with it knowledge of the present and the past, and the future, that we and the Dolichoderinae, intent on thinking the old thoughts and smelling the old smells, cannot interpret. Having eyes, we cannot see. The essential emptiness of space provides the transparency; the laws of nature provide the light, but to little avail. Our vaunted vision is merely preparatory, and perhaps only hypothetical. The trails are comfortable for little organic automata. Either our instincts are still too dominant, or our intelligence yet too rudimentary.

I believe it to be right and natural that the social insects remain static and blind in an illuminated and nonstatic universe; but not so for the social primates. The world of the insect is terrestrial; he is adjusted through long geological experience to the animate and inanimate environment. The world of the primate, on the other hand, is cosmic, and though his geological experience is recent, he is in touch with the world of stars, of atoms, of consciousness, of beauty. His is an expanding environment, made so by himself. He expands with it, in outlook and comprehension only by getting off the scented trails.

I have no advice, Mr. President, to give to your Bachelors, Masters, and Doctors. In spite of our highly specialized information they know more, much more than we do. For three reasons they are wiser: they have acquired their fragments in a later stage of the expansion; the hard economic times have probably inspired them to take their medicine more seriously; and they have not yet had time to forget. It is this wilful, and usually boastful,

forgetting, this general waste of general information, that seems to me to be one of our educational tragedies. Think how wise we have all been—with practically no trace of our wisdom now! Must your knowledge also fade and become fuzzy? Must you of this large class of highly trained and widely informed individuals go forth to your respective destinies—to the job, to the trade school, to Father's office, to the altar, to the breadline, or to whatever dire destiny the harsh fates decree—and let your hard-won intellectual stores speedily dribble away? Must you sell your text-books, stop your serious reading, so concentrate on the problem of bodily nutrition that the mind goes hungry and the intelligence atrophies? Must you, in other words, sink in a few years to our level of practically no unprejudiced general information and only a limited amount of special knowledge?

Your general information has been worth getting, and, I believe, worth retaining. Your training in argument and systematic thought—why not take pride in it, increase it? You will be the wonder class of the University of Pennsylvania, if in an appropriate number of years from now you can adequately meet the home-work questions of your fifteen-year-old sons and daughters.

It is clear that I, who am many years behind you, am in no condition to advise you; I shall confine my advisory remarks to those of my own station. Are we, who help to administer university education, and who try to advance learning along special lines—are we contributing to the high ideal of the expansion of universal knowledge? I think we really are doing something—slowly in some directions, unknowingly in others, but on the whole methodically. I point to a few places where we are venturing off the old trails or straightening out their bends.

Administrators and faculties are beginning to realize that in about fifty per cent of the fields, included in college and university training, the body of knowledge has more than doubled and the methods have completely changed in the past generation. We are assured that equally great changes will occur during the next generation. In

these fields—and practically all branches of science are included—the original college training of the older instructors may be seriously detrimental. Imagine any attempt at teaching physics or physiology now from a text-book of 1900, or with the college training of 1900.

In this expanding universe of knowledge, fairness to the modern student demands that the instructor be rejuvenated continually, or retired early. The rejuvenation is simple, and should be joyous. It merely involves further study by the instructor, preferably, of course, creative, progressive research.

We are trying to change the emphasis in education from impelling students to think chiefly the thoughts others have already thought to encouraging them (the good ones) to think their own thoughts. This means emphasis on the objective world of things, rather than on the subjective world of man and his past enterprises and mistakes. It should not mean neglect of the humanities in this scientific age, for the exploration of the human intellect, one of the greatest puzzles of the universe, is necessarily based on investigations of the way man in the past and the present carries on his fighting, singing, loving, praying, and struggle for individual existence.

There are those who propose vigorous educational reform, believing that our large colleges and universities are hopelessly futile. I do not agree. I believe that we are doing pretty well, for we must remember that our prevalent social philosophy involves mass education, and by education we seem to mean (1) the intelligent exposure of the student to knowledge in many fields, (2) the development, for accepted social ends, of cooperation and generosity in an animal that is not inherently generous and sportsmanlike, and (3) the acquisition by the student of a fairly uniform and agreeable set of mannerisms.

We are doing these things. The system, to be sure, needs and is receiving constant clinical care, by the doctors of educational administration. The reaction against such unnecessary standardization as the College Entrance

Board Examinations is growing, and would grow more rapidly but for the sincere opposition of the schoolmasters who have developed the technique for forced feeding.

The introduction of divisional and general examinations toward the end of the college course is doing something to salvage and unify the course-by-course educational system. This holding of the student responsible for his accumulation of knowledge throughout three or four years may go a long way toward stopping the rapid evaporation of cultural and intellectual assets which has left past college generations so barren and evasive.

I hope to see as another item of progress the amalgamations of some of the smaller colleges—there are nearly fifty institutions in this state giving the bachelor's degree —amalgamation for reasons of economy, for the enrichment of faculties, and because we are no longer afraid of the distances which led, several generations ago, to the sprinkling of higher educational institutions conveniently over the land.

I hope we shall also see the inauguration of the plan of the Free Student, in the colleges and universities, and perhaps also in preparatory schools. This plan looks toward the salvation of talent and genius—it is for those who cannot properly be bound by credits and academic rules. The Free Student is the young poet, inventor, experimentor, artist, dreamer, who is congenitally or temperamentally dumb or impotent outside his own passion; or one who would clearly lose his flair in the process of routine education. Most of us need and desire the discipline of classes and credits. But every year there are some who might justify freedom; who would grow by association with libraries and laboratories; and to whom in due time, for practical purposes, the academic insignia could be given. Abnormality, I insist, must be encouraged, for the world advances only through the deeds of abnormal men.

A further indication that we are making progress in adjusting college and university curricula in the expand-

ing intellectual environment is our recognition of the possibility of creative work in science and the arts for undergraduates as well as graduates, if under proper inspiration and guidance. When a subject is properly approached, *study* and *research* will be the same word.

There is no need of my airing again my prejudice (or my view, if you are kind enough to let me use the softer word) that the only worth while goal for a university is the advancement of learning. To the school and the college we can delegate the conservation of accumulated facts and attitudes; but the university should conserve nothing, except the ambition to advance. It should be in continual intellectual turmoil, it should doubt and test and explore. It should be no place for a static mind or for the methodical exploitation of sports and social graces.

But I am going too far and too fast—we cannot as yet unscramble the democracy of college and the selectivism of an institution of progressive scholarship. We are, however, tending toward this separation, or should be, by attracting to our university faculties those who cannot fail to inspire students with the spirit of inquiry.

In conclusion, I see the probability that the future goal of university education will not be the training for the proper and pleasant patrolling which we call good citizenship—that worthy standardization will be for the school and junior college. But university men and women will venture boldly off the established trails, they will make everywhere deliberate attempts to seek out the unknowns, not the known, they will think and dream for themselves and not merely go on with the thinking of thoughts of past thinkers, and the dreaming of dead men's dreams.